

February 1988

CD4014BM/CD4014BC 8-Stage Static Shift Register

General Description

The CD4014BM/CD4014BC is an 8-stage parallel input/serial output shift register. A parallel/serial control input enables individual JAM inputs to each of 8 stages. Q outputs are available from the sixth, seventh and eighth stages. All outputs have equal source and sink current capabilities and conform to standard "B" series output drive.

When the parallel/serial control input is in the logical "0" state, data is serially shifted into the register synchronously with the positive transition of the clock. When the parallel/serial control input is in the logical "1" state, data is jammed into each stage of the register synchronously with the positive transition of the clock.

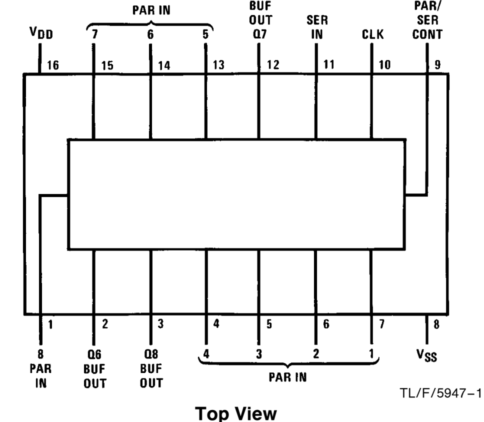
All inputs are protected against static discharge with diodes to V_{DD} and V_{SS}.

Features

- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45 V_{DD} (typ.)
- Low power TTL compatibility Fan out of 2 driving 74L or 1 driving 74LS
- 5V–10V–15V parametric ratings
- Symmetrical output characteristics
- Maximum input leakage: 1 μA at 15V over full temperature range

Connection Diagram





TL/F/5947–1

Top View

Truth Table

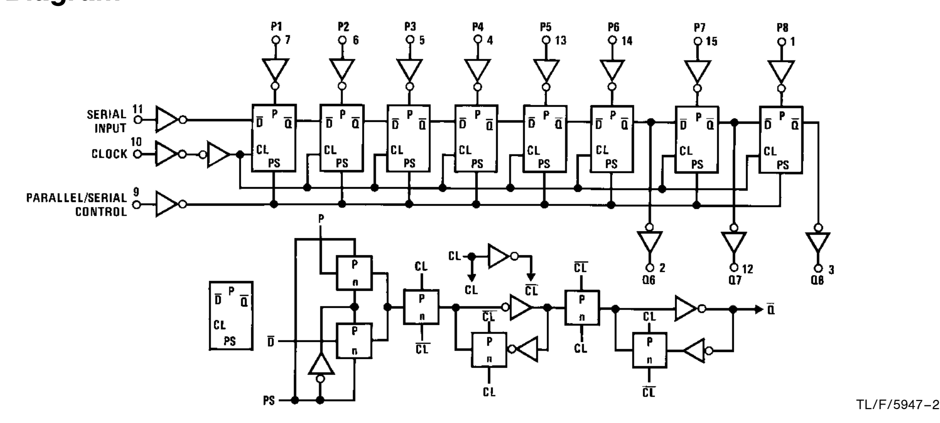
CL*	Serial Input	Parallel/ Serial Control	PI 1	PI n	Q1 (Internal)	Q_n
↑	X	1	0	0	0	0
↑	X	1	1	0	1	0
↑	X	1	0	1	0	1
↑	X	1	1	1	1	1
↑	0	0	X	X	0	Q_{n-1}
↑	1	0	X	X	1	Q_{n-1}
↓	X	X	X	X	Q1	Q_n No Change

*Level change

X = Don't care case

Order Number CD4014B

Logic Diagram



TL/F/5947–2

 TL/F/5947

RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{DD})	−0.5V to +18V
Input Voltage (V_{IN})	−0.5 to V_{DD} + 0.5V
Storage Temperature Range (T_S)	−65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Lead Temperature (T_L)	
(Soldering, 10 seconds)	260°C

Recommended Operating Conditions (Note 2)

Supply Voltage (V_{DD})	3.0V to 15V
Input Voltage (V_{IN})	0 to V_{DD}
Operating Temperature Range (T_A)	
CD4014BM	−55°C to +125°C
CD4014BC	−40°C to +85°C

DC Electrical Characteristics CD4014BM (Note 2)

Symbol	Parameter	Conditions	−55°C		+25°C			+125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V, V_{IN} = V_{DD} or V_{SS}		5		0.1	5		150	μA
		V_{DD} = 10V, V_{IN} = V_{DD} or V_{SS}		10		0.2	10		300	μA
		V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		20		0.3	20		600	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\ \mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\ \mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\ \mu A$		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\ \mu A$	4.95		4.95	5		4.95		V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\ \mu A$	9.95		9.95	10		9.95		V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\ \mu A$	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2	1.5		1.5	V
		V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6	4.0		4.0	V
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	3		3.5		V
		V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	6		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	9		11.0		V
I_{OL}	Low Level Output Current (Note 3)	V_{DD} = 5V, V_O = 0.4V	0.64		0.51	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.6		1.3	2.2		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	4.2		3.4	8		2.4		mA
I_{OH}	High Level Output Current (Note 3)	V_{DD} = 5V, V_O = 4.6V	−0.64		−0.51	−0.88		−0.36		mA
		V_{DD} = 10V, V_O = 9.5V	−1.6		−1.3	−2.2		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−4.2		−3.4	−8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.10		-10^{-5}	−0.10		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.10		10^{-5}	0.10		1.0	μA

DC Electrical Characteristics CD4014BC (Note 2)

Symbol	Parameter	Conditions	−40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V, V_{IN} = V_{DD} or V_{SS}		20		0.1	20		150	μA
		V_{DD} = 10V, V_{IN} = V_{DD} or V_{SS}		40		0.2	40		300	μA
		V_{DD} = 15V, V_{IN} = V_{DD} or V_{SS}		80		0.3	80		600	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\ \mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\ \mu A$		0.05		0	0.05		0.05	V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\ \mu A$		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V, $\lvert I_O \rvert < 1\ \mu A$	4.95		4.95	5		4.95		V
		V_{DD} = 10V, $\lvert I_O \rvert < 1\ \mu A$	9.95		9.95	10		9.95		V
		V_{DD} = 15V, $\lvert I_O \rvert < 1\ \mu A$	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2	1.5		1.5	V
		V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6	4.0		4.0	V
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V	3.5		3.5	3		3.5		V
		V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	6		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	9		11.0		V
I_{OL}	Low Level Output Current (Note 3)	V_{DD} = 5V, V_O = 0.4V	0.52		0.44	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.3		1.1	2.2		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	3.6		3.0	8		2.4		mA

DC Electrical Characteristics CD4014BC (Note 2) (Continued)

Symbol	Parameter	Conditions	−40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{OH}	High Level Output Current (Note 3)	$V_{DD} = 5V$, $V_O = 4.6V$	−0.52		−0.44	−0.88		−0.36		mA
		$V_{DD} = 10V$, $V_O = 9.5V$	−1.3		−1.1	−2.2		−0.90		mA
		$V_{DD} = 15V$, $V_O = 13.5V$	−3.6		−3.0	−8		−2.4		mA
I_{IN}	Input Current	$V_{DD} = 15V$, $V_{IN} = 0V$		−0.3		-10^{-5}	−0.3		−1.0	μA
		$V_{DD} = 15V$, $V_{IN} = 15V$		0.3		10^{-5}	0.3		1.0	μA

AC Electrical Characteristics* $T_A = 25°C$, input t_r, $t_f = 20$ ns, $C_L = 50$ pF, $R_L = 200$ kΩ

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}, t_{PLH}	Propagation Delay Time	$V_{DD} = 5V$		200	320	ns
		$V_{DD} = 10V$		80	160	ns
		$V_{DD} = 15V$		60	120	ns
t_{THL}, t_{TLH}	Transition Time	$V_{DD} = 5V$		100	200	ns
		$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	80	ns
f_{CL}	Maximum Clock Input Frequency	$V_{DD} = 5V$	2.8	4		MHz
		$V_{DD} = 10V$	6	12		MHz
		$V_{DD} = 15V$	8	16		MHz
t_W	Minimum Clock Pulse Width	$V_{DD} = 5V$		90	180	ns
		$V_{DD} = 10V$		40	80	ns
		$V_{DD} = 15V$		25	50	ns
t_{rCL}, t_{fCL}	Clock Rise and Fall Time (Note 4)	$V_{DD} = 5V$			15	μs
		$V_{DD} = 10V$			15	μs
		$V_{DD} = 15V$			15	μs
t_S	Minimum Set-Up Time (Note 6) Serial Input $t_H \geq 200$ ns	$V_{DD} = 5V$		60	120	ns
		$V_{DD} = 10V$		40	80	ns
		$V_{DD} = 15V$		30	60	ns
	Parallel Inputs $t_H \geq 200$ ns	$V_{DD} = 5V$		80	160	ns
		$V_{DD} = 10V$		40	80	ns
		$V_{DD} = 15V$		30	60	ns
	Parallel/Serial Control $t_H \geq 200$ ns	$V_{DD} = 5V$		100	200	ns
		$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	80	ns
t_H	Minimum Hold Time Serial In, Parallel In, $t_S \geq 400$ ns Parallel/Serial Control	$V_{DD} = 5V$			0	ns
		$V_{DD} = 10V$			10	ns
		$V_{DD} = 15V$			15	ns
C_I	Average Input Capacitance (Note 5)	Any Input		5	7.5	pF
C_{PD}	Power Dissipation Capacitance (Note 5)			110		pF

*AC Parameters are guaranteed by DC correlated testing.

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: $V_{SS} = 0V$ unless otherwise specified.

Note 3: I_{OL} and I_{OH} are tested one output at a time.

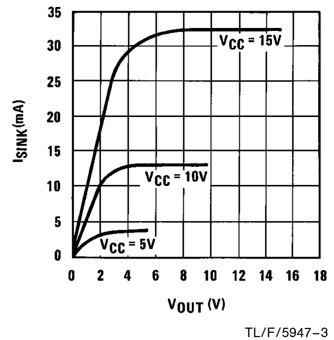
Note 4: If more than one unit is cascaded t_{rCL} should be made less than or equal to the fixed propagation delay of the output of the driving stage for the estimated capacitive load.

Note 5: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation, see 54C/74C family characteristics application note AN-90.

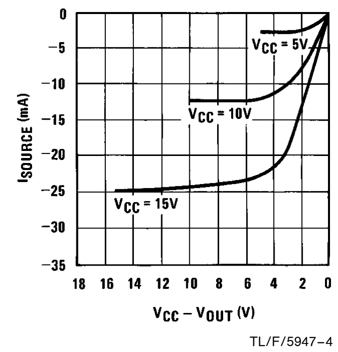
Note 6: Setup times are measured with reference to clock and a fixed hold time (t_H) as specified.



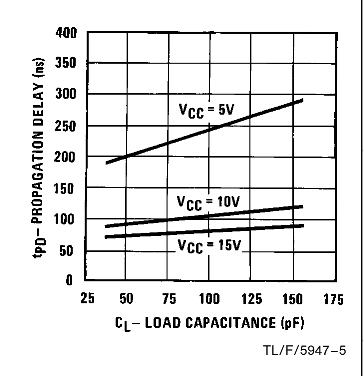
Typical Performance Characteristics



TL/F/5947–3

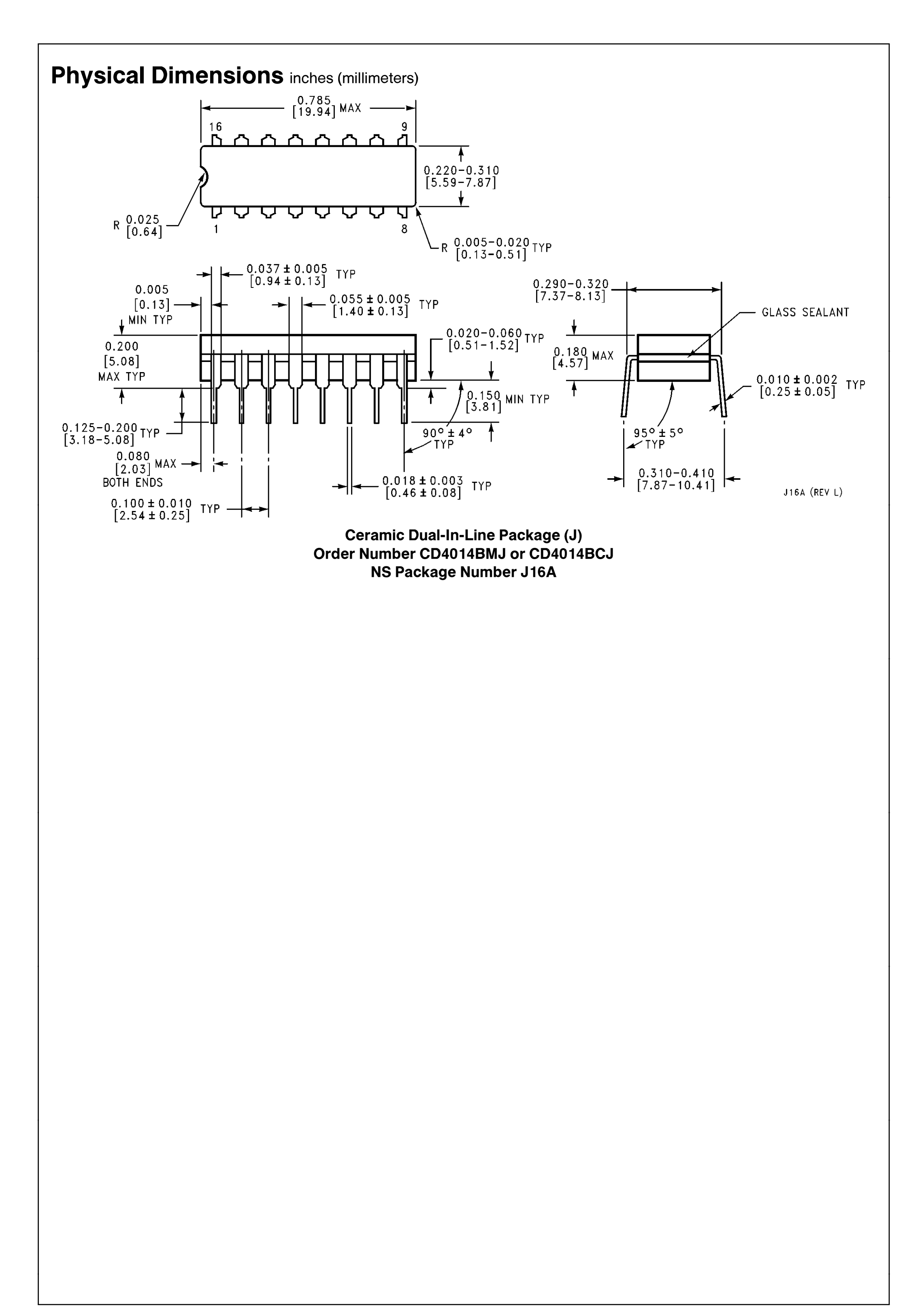


TL/F/5947–4



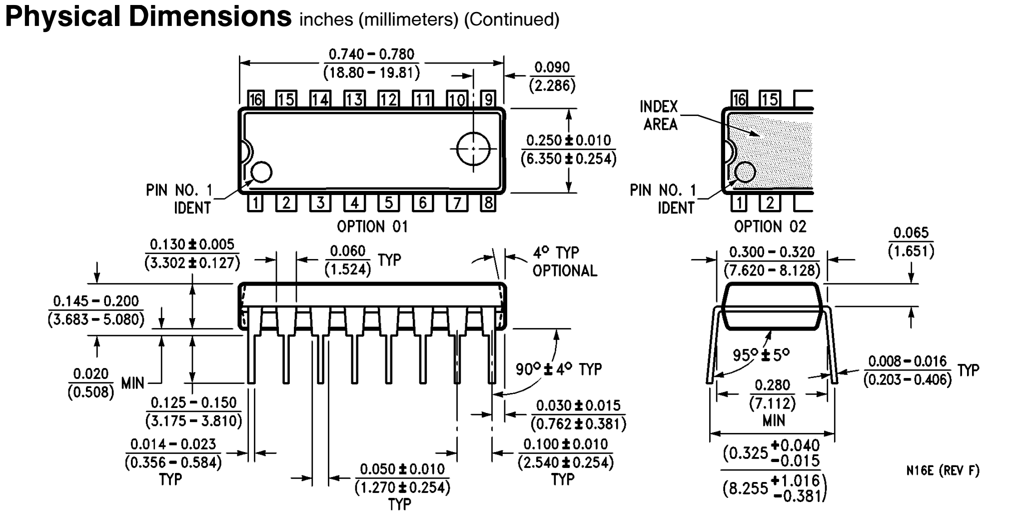
TL/F/5947–5

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number CD4014BMJ or CD4014BCJ
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number CD4014BMN or CD4014BCN
NS Package Number N16E



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